LAWRENCE E. DECINA

NEW AND REVISED RECORDS OF PLEISTOCENE MAMMALS OF NEW JERSEY

David C. Parris

Bureau of Science, New Jersey State Museum
Trenton, New Jersey 08625

> "In the consideration of the problems of Pleistocene geology and paleontology, New Jersey is one of the most important states."
>
> O. P. Hay (1923)

While it has long been recognized that New Jersey is an interesting place for studies of the Pleistocene, its record of fossil mammals of that epoch is unfortunately poor. The spectacular and famous specimens of large mammals are an unsatisfactory representation of the Pleistocene mammalian fauna, and serve primarily to impart an even greater feeling of mystery about that time, when glacial and interglacial ages dominated the earth's climates, and humans finally came into prominence. Although Hay recognized the critical geographic position of New Jersey, his expectations have not been realized at least in terms of faunal data.

While a review of present knowledge does not necessarily contribute new data, at least it may clarify the existing record. Furthermore, the reviews of Hay (1923), Richards (1951), and Jepsen (1959 and later revisions) are now rather out-of-date, although they remain valuable references. It is hoped that the present work will serve the scientific community, both amateur and professional, as an additional reference.

Acknowledgements

I thank Dr. E. Shapiro for suggesting this paper and for useful suggestions. Dr. A. G. Edmund, Dr. D. Baird, Dr. R. C. Wood, G. Sawyer, C. Smart, A. Rodriguez, L. G. Vostreys, A. Krieger, and R. DeVries provided information on specimens in their care as well as other valuable information. Drs. D. Baird and C. Ray kindly reviewed the manuscript.

The following museums are represented by the letters indicated:

AMNH	American Museum of Natural History
ANSP	Academy of Natural Sciences of Philadelphia
BCM	Bergen Community Museum
NJSM	New Jersey State Museum
NMNH	National Museum of Natural History (Smithsonian)
NSM	Natural History and Science Museum, Blairstown, New Jersey
PU	Princeton University

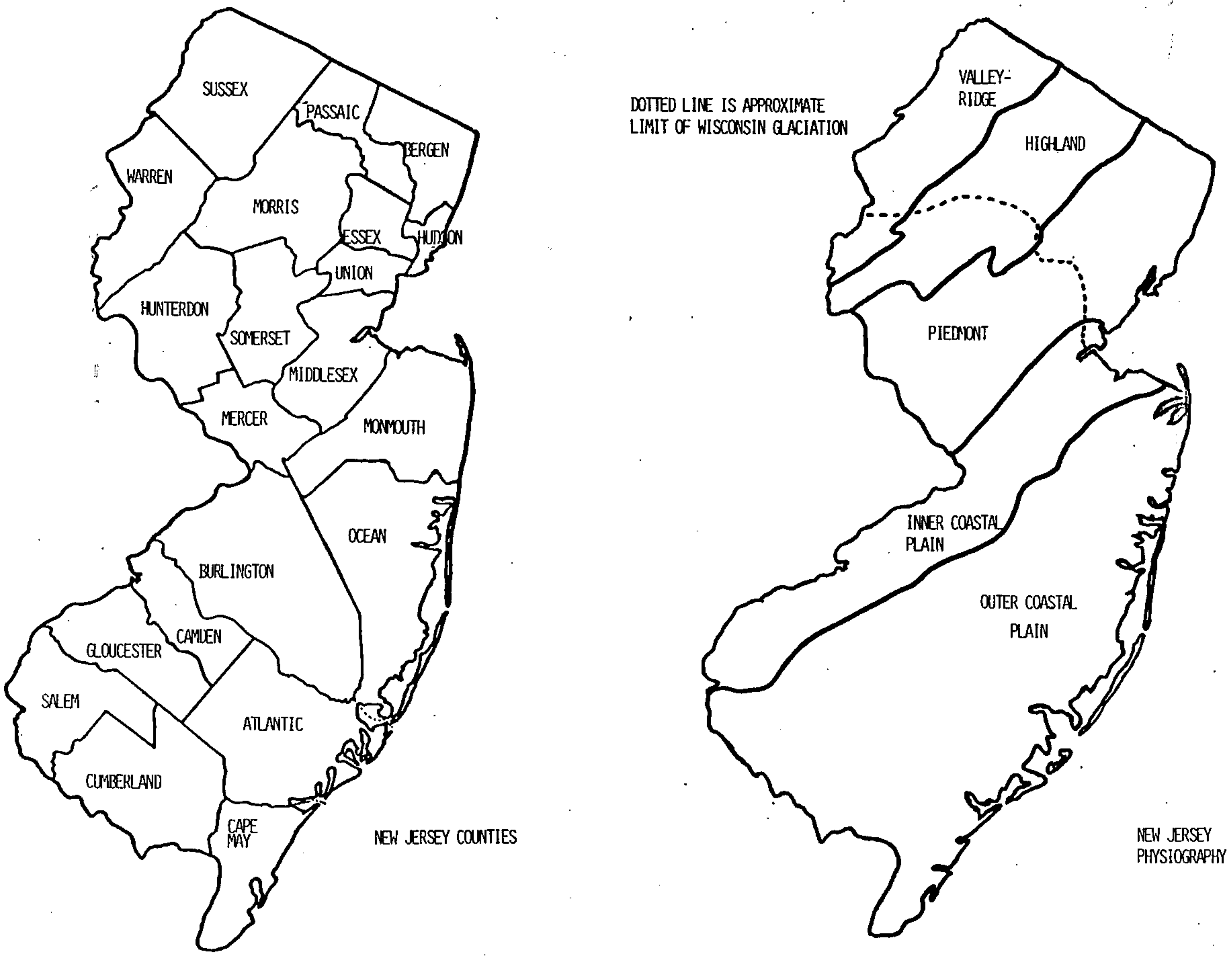


Figure 1. New Jersey Counties and Physiographic Provinces

New Jersey Pleistocene Sediments and Their Fossils

The extent of glacial and interglacial deposits in New Jersey is great, with virtually every area of the state yielding some types of Pleistocene sediments. The distribution of fossils is, however, quite uneven.

In the northwestern counties, where numerous Pleistocene bog deposits are found, the records of extinct mammals are also relatively common. These bogs existed just south of retreating continental ice sheets and yield very well preserved specimens, including some virtually complete skeletons. Typical strata in a bog include basal blue clays, overlain by pond muds (often called marl or shell-marl, from the clam and snail shells frequently found in them), topped by peat, representing the overgrowth of the pond, filled by plant material.

These bog deposits are especially noted for their yield of mastodon (Mammut) specimens, as well as several excellent elk-moose (Cervalces) skeletons. The wide range of individual ages and lack of evidence of injuries support the traditional interpretation that most of these specimens are the remains of animals which were mired and trapped in the bogs. Few show evidence of old age or injury.

Other Pleistocene deposits of northern New Jersey have not as yet yielded many specimens, although cave deposits and bedded drift sediments still offer potential collecting. The Castoroides specimen from the Fairy Hole Rock Shelter indicates that Pleistocene mammals indeed occur in New Jersey caves, and such occurrences are well-known in Pennsylvania where they are a major source of specimens.

While the "Yellow Gravels" of the Pleistocene of southern New Jersey seldom yield fossils, notable exceptions are the brook sites of Monmouth County, in which bedded Pleistocene deposits (apparently fluvial) overlie the Cretaceous and Tertiary formations of the coastal plain. Isolated bones are regularly found in the brook point bars, although mixed with Cretaceous, Colonial, and Recent materials in a confusing composite assemblage. Despite the difficulty of interpreting their precise ages, these isolated records afford welcome glimpses of Pleistocene life, as they include taxa unrepresented in the northern bog deposits.

The third major group of Pleistocene records consists of specimens dredged from the continental shelf. Scallop fishermen, and other people who regularly inspect samples of bottom muds, have obtained numerous specimens of both terrestrial and marine mammals, most of which are presumably Pleistocene. Although many specimens undoubtedly remain in private hands (or are discarded) and precise locality data are seldom obtained, these occurrences provide yet another source of evidence. The almost total lack of stratigraphy and dating of such specimens essentially reduces them to evidence of presence during a vaguely-defined period.

The overall picture of Pleistocene fossil sources of New Jersey, therefore, is abundance and variety of sediments, yielding isolated specimens with few contextual data. Systematic collecting and thorough analysis are still in the future.

The Recent Fauna in Pleistocene Perspective

Despite its great human population and small area, New Jersey retains a substantial number of native land mammal species. Included are one marsupial species, eight insectivores, one primate, some ten bats, three lagomorphs, seventeen rodents, ten carnivores, and one artiodactyl (McManus, 1974). In part, the number of species is attributable to New Jersey's diversity of environments distributed among six physiographic provinces (marine, outer coastal plain, inner coastal plain, piedmont, highland, and valley-ridge), largely based on differing geologic formations and structures.

Presumably, most of the species in the present-day fauna also lived in what is now New Jersey during the Pleistocene, and undoubtedly many others occurred within the area whenever the climate was favorable. However, because no proven Pleistocene record exists for most of these species, most supposed ranges during the Pleistocene are speculative.

The reason for this sad paucity of records is that most mammal fossils of New Jersey are isolated specimens, and it is difficult to state definitely that an isolated specimen is a Pleistocene fossil if it comes from an animal known from the present fauna. Preservation of the specimen is at best an unreliable clue to its age; many specimens from colonial time in New Jersey are preserved in the same way as specimens known to be Pleistocene in age, or are even more strongly stained or permineralized.

Also, most of the mammals that became extinct around the end of the Pleistocene epoch were large. Their large sturdy bones were much more likely to be fossilized and discovered than the more fragile skeletons of small mammals (such as most of the species now inhabiting New Jersey).

Finally, it must be admitted that little attention has been given to the possibility of Pleistocene small mammals in New Jersey. Cave deposits, where specimens could occur, were often dug up quite unscientifically by artifact hunters of past decades. Professional paleontologists have seldom applied their best collecting techniques to New Jersey Pleistocene deposits. Specimens of possible Pleistocene age have been ignored or even discarded if they were identified as belonging to a species of the present-day fauna. All of these factors have left us with little fossil evidence of the animals whose territory we now share. We know a few details about some species, however, and know considerably more about those whose ranges have been affected by human activity. These will be discussed briefly here.

The opossum, Didelphis virginiana, has only recently become a common animal throughout New Jersey. There is little, if any, evidence of the opossum in prehistoric archaeological sites of northern New Jersey, and no fossil evidence for earlier times (Guilday, 1953). It seems likely that this interesting North American marsupial, which thrives near civilization, is expanding its range due to environmental conditions we have created, possibly assisted by introduction by humans as in some western states.

There is no reliable record of the New England Cottontail, Sylvilagus transitionalis, from New Jersey, although biogeographers have long suspected it may occur here. Archaeological evidence from Pennsylvania suggests that it was once more widespread than at present (Doutt et al., 1967). Until recently, this species was probably declining, displaced by the Eastern Cottontail (S. floridanus) which normally occupies more open areas, such as those created by clearing of land for farms. The New England Cottontail was probably present in this area during Pleistocene times.

There is no reliable evidence for the red fox, Vulpes vulpes, in New Jersey except during recent years. It is generally believed to have entered New Jersey during colonial times after land clearing had created more suitable habitats for it. (Prior to that time it had a more northerly range.) It was a potential resident of what is now New Jersey during the various Pleistocene climatic fluctuations, but its presence today is due to a relatively recent immigration.

The coyote, Canis latrans, is presently increasing its range. Enough specimens are now known from New Jersey to warrant its listing as part of the fauna. This species, perhaps interbred with the gray wolf (Canis lupus) and domestic dog (C. familiaris), appears to have entered our area within this century and has no archaeological or paleontological record here (Bekoff et al., 1975).

Of course, there also have been well-documented historical extirpations, such as those of the gray wolf (Canis lupus), mountain lion (Felis concolor), elk (Cervus canadensis), and beaver (Castor canadensis), all of which could be expected as fossils in Pleistocene sediments. Richards (1951) cited a supposed Pleistocene beaver specimen (ANSP 11583) from Medford but its age is uncertain. A radius of Canis (wolf?), ANSP 11623, possibly Pleistocene, was cited by Richards (1951) but incorrectly identified as Ursus. Hay (1923) noted remains of a wolf from Fish House, Camden County.

The cervid genera Odocoileus and Cervus were also recorded from other supposed Pleistocene occurrences by Hay (1923).

Richards (1951) also cited a record of a muskrat, Ondatra zibethica (Linnaeus). This specimen (ANSP 11586), cited as a lower jaw, is actually a skull. Its Pleistocene age is questionable.

A definite record of a Pleistocene muskrat was obtained at the Big Brook locality in Marlboro Township, Monmouth County. The specimen (NJSM 12115), a subadult femur, was collected from the same bed as a Castoroides specimen (NJSM 11883).

Other material of possible Pleistocene age was associated with the type specimen of Grus proavus Marsh from Monmouth County. Although questionably Pleistocene, there is nothing in the collection to suggest otherwise. The specimens include white-tailed deer, Odocoileus virginianus, a subadult mandible with the deciduous third and four premolars, and all three molars, the third unerupted (PU 25426); raccoon, Procyon lotor, a rostral fragment with the left second molar and a fragmentary right innominate (PU 23427); and a vulpine, cf. Urocyon, represented by a left innominate and a right tibia (PU 23428).

Humans (Homo sapiens) apparently lived in what is now New Jersey during the latter part of the Pleistocene, perhaps considerably more than 10,000 years ago. Probably some of the extinct large mammals of the Pleistocene were encountered by aboriginal humans at least casually, although there are no sites that demonstrate associations. No Pleistocene human remains have been found in New Jersey, although cultural evidence of Paleoindians is well-known.

Obviously much remains to be learned about Pleistocene occurrences of mammals that occur in the modern fauna. More specimens are needed.

Pleistocene Megafauna

The following animals are commonly considered to be members of the Pleistocene megafauna. Most of these genera are extinct, but several are recent mammals now found in more northerly regions. In an effort to consolidate the published records of these mammals, all known specimens are cited, or previous lists noted. Cetaceans are not treated in this paper, although they are known from numerous fragmentary Quaternary specimens.

Order Endentata

Family Megalonychidae

Genus Megalonyx

Commonly called Jefferson's ground sloth, this large edentate is poorly represented in faunas of the northeastern states, despite a wide range that includes Alaska and the Northwest Territories. The two New Jersey records include, appropriately, a claw similar to those which inspired the generic name "Giant Claw."

ANSP 15232: Five vertebrae and several unidentified bones (Richards, 1951). The locality was at the New Jersey Turnpike crossing of Pennsauken Creek between Mt. Laurel Township, Burlington County, and Cherry Hill Township, Camden County. The specimen was recovered from a gravel, mapped as Cape May Formation. It was compared to M. jeffersonii in Richards' citation.

NJSM 11871: Terminal phalanx of pes. Collected during July, 1973, at the Big Brook locality, in Marlboro Township, Monmouth County, by John Brzostoski. This previously unpublished specimen apparently was eroded from the Pleistocene formation which overlies the Cretaceous Navesink Formation in the brook channel. The Pleistocene bed is a fluvial channel deposit which is traceable downstream into the Cape May Formation and has, in fact, previously been mapped as Cape May Formation. Although older Pleistocene formations are found in the area, it is unlikely that the specimen came from them because of the fragility of the specimen and the distance from outcrops of the other formations. The specimen is well-preserved, but the sheath is missing. It measures approximately 220 millimeters along the dorsal curvature. It is shown in Figure 2, photographed on a centimeter grid. The great depth relative to the length is characteristic of the claws of the pes, of which this specimen would be the third digit on the basis of size. All characteristics support a reference to Megalonyx, but no specific identification is possible. While a precise age determination cannot be made, the bed is believed to have been deposited during the early part of the Wisconsin glacial age. The presence of sloth remains, however, suggests a warmer climate, raising the possibility of correlation with the latter part of the Sangamon interglacial or an interstadial portion of the Wisconsin glacial age instead.

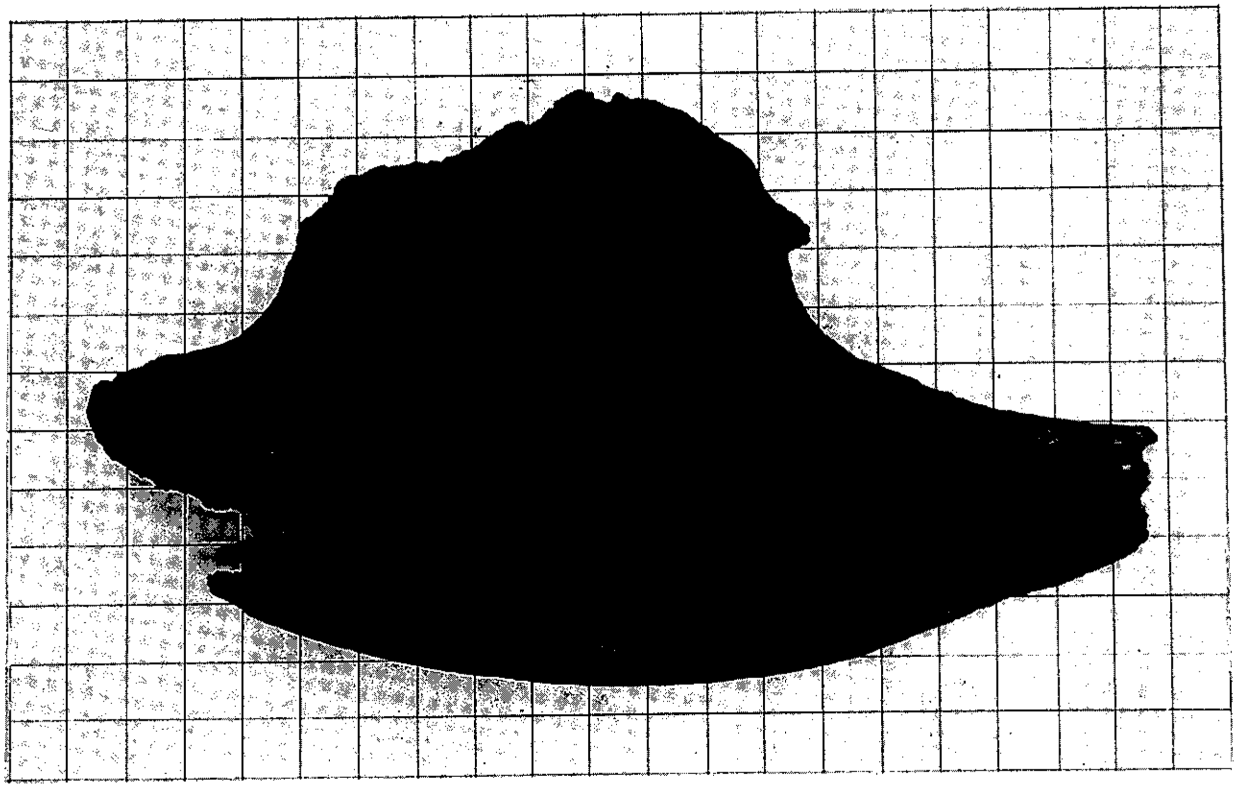


Figure 2. Megalonyx, terminal phalanx of pes, from the Big Brook locality, Marlboro Township, Monmouth County (NJSM 11871). Photographed on a centimeter grid.

Family Megatheriidae

Genus Eremotherium

This enormous ground sloth is commonly found in southern states. The New Jersey specimen is considered quite northerly and was possibly near the limits of the range.

AMNH 14443: A right calcaneum, collected at Long Branch, Monmouth County, in 1883, is referred to *Eremotherium mirabile* (Leidy) (Edmund, 1979, personal communication).

Previous authors listed this specimen as *Megatherium* (Hay, 1923; Richards, 1951), the customary practice prior to referral of the North American form to *Eremotherium*. The geologic age of the specimen, unfortunately, cannot be determined precisely.

Order Rodentia

Family Castoridae

Genus Castoroides

This large beaver was apparently common in eastern North America. Although much of the skeleton is known from various specimens, in New Jersey only two teeth have been found, from two widely different sources.

NJSM-ISS-20036: Probably a left lower first molar, was recovered in 1936 during Indian Site Survey excavations at Fairy Hole Rock Shelter, Allamuchy Township, Warren County (Cross, 1941). It is referred to *Castoroides ohioensis* Foster.

The alleged association of Indian artifacts with this specimen was doubted by Parris and Case (1980). However, James Zamos, of Newton, New Jersey, has recently revealed that he had discovered a fluted projectile point, characteristic of Paleoindian culture, at the same locality. This indicates an earlier human presence at Fairy Hole Rock Shelter than was previously demonstrable, and reopens the possibility of human association with *Castoroides*. However, no association can be proven.

NJSM 11883: A left upper first molar, was found at the Big Brook locality, Marlboro Township, Monmouth County, by David Markunas in 1977. It was recovered from the fluvial equivalent of the Cape May Formation. It, too, is referred to *Castoroides ohioensis*. Illustrated in Figure 3.

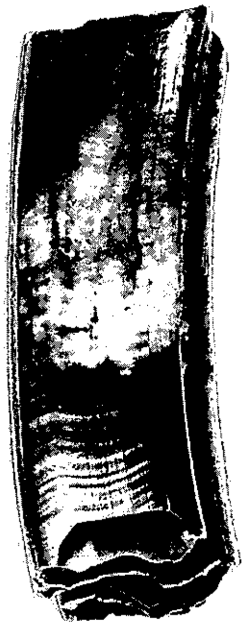
Order Carnivora

Family Odobenidae

Genus Odobenus

Walruses apparently were common along the Middle Atlantic Coast during the Pleistocene. Numerous specimens have been found, and can scarcely be listed exhaustively. However, several previously unpublished records may be added to those of Ray (1975), Kardas (1965), Richards (1951), Hay (1923), and Leidy (1860). Essentially all recorded specimens were dredged from the continental shelf, and are referred to the living species, *Odobenus rosmarus* Linnaeus.

NJSM 11260: A skull with left tusk and two other teeth was dredged from the Atlantic Shelf about 40 miles east of Barnegat, according to Harold Francis, who donated the specimen in 1961.



a. Length approx. 50 mm.

b. Occlusal dimensions approx. 15 mm x 17 mm.

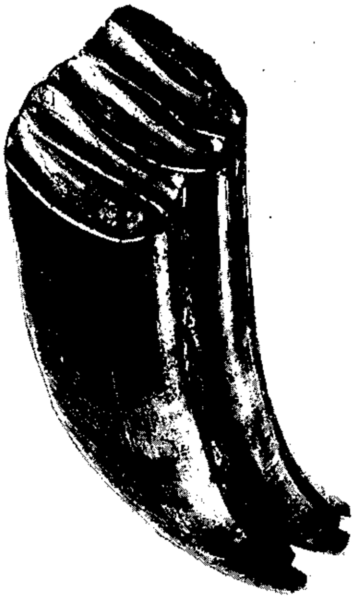


Figure 3. Castoroides ohioensis, left upper first molar, from the Big Brook locality, Marlboro Township, Monmouth County (NJSM 11883).

ANSP 15552: A mandible was dredged from the Delaware River near Delair, Pennsauken Township, Camden County, in 1967. The specimen is water-worn, and no traces of alveoli remain, but it is still identifiable. The specimen is of particular interest since it comes from the Delaware River, rather than from marine waters.

PU 21574: A left innominate (pelvis) was recovered by clam draggers off Point Pleasant in 1969. Chris Laskowich and Harold Mendryk donated this specimen in 1972.

NJSM 11906: A water-worn rostrum with fragmentary tusks and vestiges of postcanine alveoli. This specimen was dredged off New Jersey, but no precise locality is known, according to James Hurley who donated the specimen in 1978.

Order Proboscidea

Family Mammutidae

Genus *Mammut*

Unquestionably the most famous of New Jersey Pleistocene mammals, the mastodons are probably as well-studied as any known fossil mammals. The record of this genus in New Jersey was summarized by Jepsen (1959 and later editions) and offshore records were given by Whitmore *et al.* (1967), so only some later specimens will be recorded here. All are referred to *Mammut americanum* (Kerr), except as otherwise noted.

BCM (unnumbered): A major portion of a skeleton was found near Hackensack, Bergen County, in 1962. It is now exhibited in the Bergen County Museum, in a position similar to that in which it was found, and is commonly called the Hackensack mastodon.

Sussex Historical Society: A major portion of a skeleton was excavated in 1962 by the Sussex Historical Society and is exhibited in their museum in the Hill Memorial Building in Newton, New Jersey. It was found in Hampton Township near Don Bosco College.

NJSM 12114: Tusks and a few other bone fragments were recovered near Hackettstown in 1965. The specimens are fragmentary but are identifiably mastodon, rather than mammoth. The material came from the property of William Hulse, on Petersberg Road, in Independence Township.

NSM 109: A major portion of a skeleton (from Blairstown Township, Warren County) is exhibited in the museum of Gary J. Sawyer in Paulina. Mr. Sawyer excavated this specimen in 1969. It was found on the propery to Paul Nehr, about three miles north of the town of Blairstown, on Kerr's Corner Road.

NJSM 11253: A sixth cervical vertebra was dredged from a depth of eleven feet on Catesville Road near Fort Dix (in Pemberton Township, Burlington County, in 1969).

NJSM 11267: A nearly complete skeleton was found on the property of Stanley Bojak in Liberty Township, Warren County, during 1971. This specimen is now mounted in the Natural History Hall at the State Museum. It yielded a radiocarbon date of 10,995 ± 750 radiocarbon years B.P. (Kraft, 1973).

NJSM 11268: A major portion of a skeleton was recovered during highway construction in Sparta Township, Sussex County, in 1972. This specimen is generally called the Sparta mastodon, and is notable for its radiocarbon dates, described in the Addendum to this paper.

BCM (unnumbered): A major portion of a skeleton was recovered in 1974 in Norwood Borough, Bergen County, on property of the Hackensack Water Company. This specimen is now mounted at the Bergen Community Museum, and commonly called the Dwarskill mastodon.

NJSM 11874: A tooth cusp was found by G. R. Case on 26 April 1975. He donated it to the State Museum. This specimen came from the Big Brook locality in Marlboro Township, Monmouth County, where it had eroded from the Pleistocene beds that overlie the Cretaceous Navesink Formation. It was found about halfway from the Boundary Road Bridge to the Railroad Bridge over the brook.

Unnumbered Specimen: A large sternebra was found in the spring of 1978 by Fred DeHaan on his property in Wantage Township, Sussex County. This bone resembled that of a mastodon in all respects, and is tentatively referred to Mammut americanum. The bone is in Mr. DeHaan's possession, but he kindly allowed the State Museum to borrow and photograph it. Precise locality data will not be published at Mr. DeHaan's request.

Family Elephantidae

Genus Mammuthus

Pleistocene elephants (or mammoths) are known from only a few New Jersey specimens. Possibly two species are represented by the known materials.

PU 11950: This molar is believed to be the specimen described by Hay (1923), and referred to Elephas primigenius (Blumenbach) now in the genus Mammuthus, and commonly called the woolly mammoth. The specimen was found in Trenton, Mercer County. This specimen is now on long-term loan to the New Jersey State Museum.

Rutgers University Geological Museum (unnumbered): This is apparently the North Plainfield specimen described by Hay, who referred it to M. primigenius. It probably came from Union County, as stated by Hay (North Plainfield is actually in Somerset County). The exact municipality cannot be determined.

Remarks: Mammuthus columbi (Falconer), another species of mammoth, is allegedly represented in records from New Jersey, but this is not certain. Hay (1923) reported a specimen from Middletown, Monmouth County, but knew nothing firsthand of the actual specimen. Another specimen was found in 1932 in Gloucester Township, Camden County, and identified as M. columbi by Dr. Barnum Brown (Richards, 1951). However, the present location of this specimen is apparently unknown, and the identification cannot be verified. The problems of identification of the various species of mammoths have been discussed by Whitmore et al. (1967) and Kurtén and Anderson (1980), and it seems advisable in view of their discussions to avoid specific assignments except for specimens of good quality. Several mammoth teeth cited by Whitmore et al. (1967) were from the coast off New Jersey, but no specific assignments were possible. There is considerable overlap of supposed characteristics of the dentitions of the various species.

Order Perissodactyla

Family Equidae

Genus Equus

There are few records of Pleistocene horses from New Jersey. Documentation and certain identification remain serious problems for the specimens, since they are distinguished from colonial and recent specimens only with great difficulty. No authenticated specimens have been discovered in recent years. Hay (1923) summarized a small number of earlier records, supposedly including two species, *E. complicatus* and *E. fraternus*. The latter species cannot be confirmed, as the specimen was lost.

ANSP 11484: This dentition, described by Woolman (1897) and mentioned by Hay (1923), was referred to *Equus complicatus* Leidy. Still the best documented Pleistocene horse from New Jersey, it provided critical information in dating the Fish House locality in Camden County.

NJSM 10411: This specimen of right upper molar or premolar from Roxbury Township, Morris County, originally cited by Richards (1951), cannot be identified to species. It may be an authentic Pleistocene record. This specimen is indistinguishable from teeth of domestic horses, however.

Order Artiodactyla

Family Cervidae

Genus *Cervalces*

One of the most famous New Jersey fossils, and certainly the fossil genus most closely associated with New Jersey, is the so-called elk-moose. Both of the definitive specimens were found in New Jersey, and most specimens from elsewhere are rather poor. The distinctive antlers with their long main beams and palmate tips are truly intermediate between the elk and the moose. *Cervalces* and *Castoroides* apparently lived in similar climates and terrain as their ranges coincide rather well.

PU 10648: This excellent skeleton remains the best specimen of the genus. It was found in Mt. Herman, Hope Township, Warren County, and described by Scott (1885).

NSM 264: A major portion of a skeleton of *Cervalces scotti* Lydekker is presently under study by G. J. Sawyer of Paulina, Blairstown Township, Warren County. The specimen came from a mosquito ditch near Hainesburg River Road in Knowlton Township, Warren County. Although found in 1969 by the property owner, Ralph Babcock, the majority of the specimen was collected in 1973.

NJSM 12109: An antler fragment was found by Scott Velasco in 1978 at the Big Brook locality, in Colts Neck Township, Monmouth County. This specimen adds yet another genus to the considerable record of Monmouth County, which Hay (1923) mentioned as notable. Although fragmentary, the size, the shape of palmation, and the surface textural features indicate a reference to *Cervalces*.

Genus *Rangifer*

The living species, *Rangifer tarandus* Linnaeus, undoubtedly ranged within what is now New Jersey during colder episodes of the Pleistocene epoch. Unfortunately, only an antler fragment serves as evidence of the caribou in this area. Two specimens were noted by Hay (1923), but one of them, a supposed Trenton record, had already been discredited by other authorities. It will not be considered here.

ANSP 11576: A fragment of left antler, found near Vincentown, Southampton Township, Burlington County, appears to be an authentic record of a Pleistocene caribou (Leidy, 1869). It was, however, of rather unusual form as noted by Hay (1923), lacking a brow tine. That condition may be seen in recent individuals, however, so there is no reason not to refer the antler to *Rangifer tarandus*.

Genus Symbos

This extinct muskox is represented by only one New Jersey record. As discussed below, the supposed ovibovine specimen reported by Volk is not considered a valid record.

PU 16340: A left frontal and horn core, dredged from the continental shelf (Whitmore *et al.*, 1967), belongs to the extinct species *Symbos cavifrons* (Leidy). Illustrated in Figure 4.

Unsubstantiated and Incorrect Records

A number of genera and species have been reported for the Pleistocene of New Jersey for which records are erroneous or open to serious question.

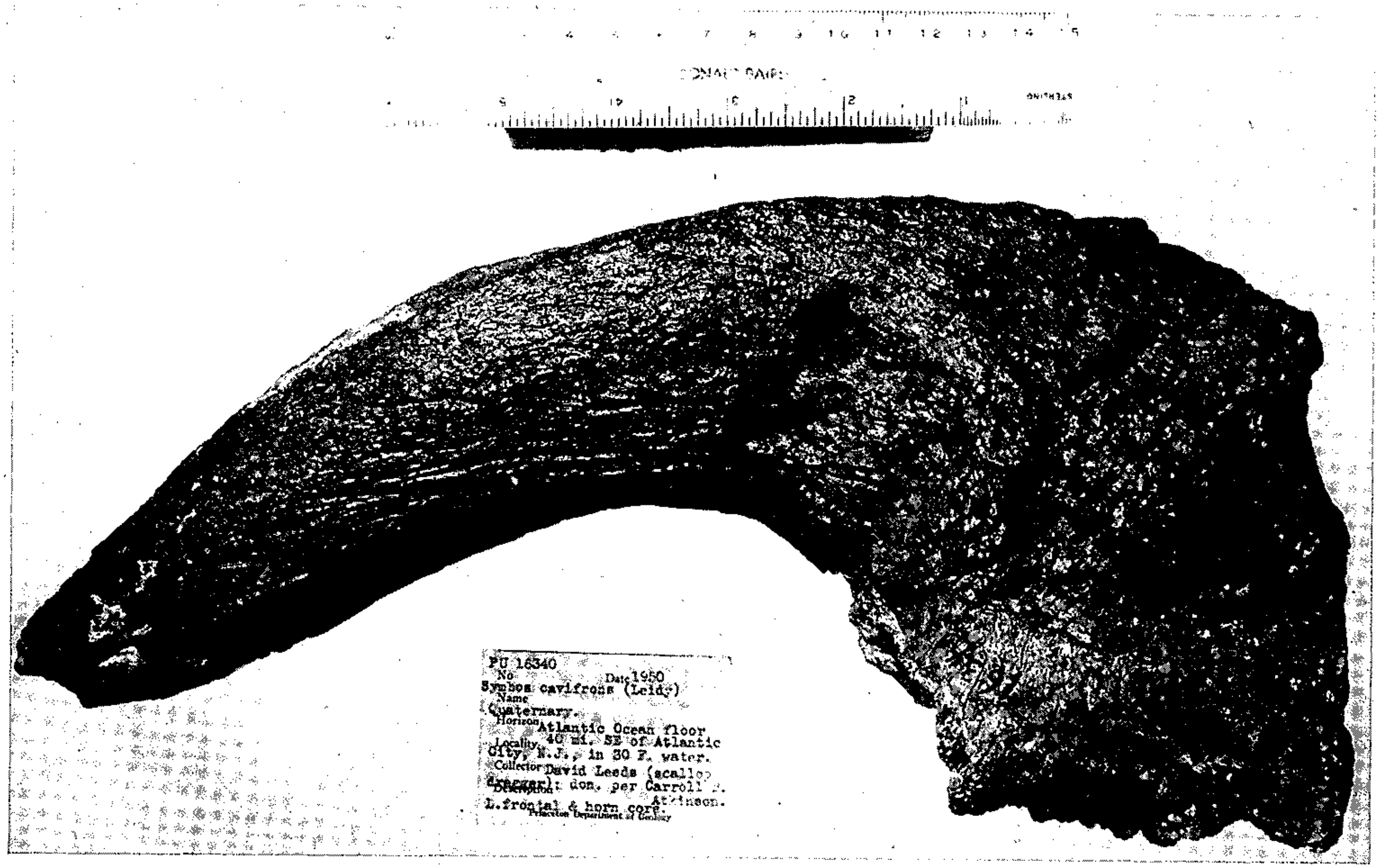
Ursus sp.: As previously noted, the radius (ANSP 11623) attributed to *Ursus* sp. by Richards (1951) is actually referable to *Canis*.

Bison sp.: All previous records of New Jersey *Bison* specimens are incorrect or very questionable. The specimen reported by Richards (1951), ANSP 15167, cannot be distinguished from domestic *Bos*. The specimen found by Harold Wooley (NJSM 3838--Archaeology Collection) and reported by Richards (1951) cannot now be located, but another alleged *Bison* tooth found by Wooley is in the Ocean County Historical Museum. It, too, is indistinguishable from domestic *Bos taurus*, suggesting that Wooley was unable to differentiate them. Without horn cores or major skull fragments, the identification would be doubtful in any case. The *Bison* remains reported by Volk (1911) included a femoral fragment found only 2.5 feet from the surface. It is poorly preserved and would not likely have been identified as *Bison*, but as *Bison* or *Bos*, if it had not been assumed that the find was prehistoric. The same can be said of the first right upper molar, also cited by Volk (1911), which was also found in a sand-pit. It was conceded by Dr. G. M. Allen to be indistinguishable between *Bison* and *Bos*, and its identification as *Bison* depended completely on stratigraphy. It is clear from reading Volk's publication that great care had been taken to assure the integrity of his discoveries. However, neither of these two finds can be accepted with confidence. The femur was found in such a shallow position that it could have been a recent intrusive. The tooth was not found by Volk, but by a sandpit worker whose appreciation of stratigraphic precision may have been inadequate. In general, although Volk's work appears to have been carefully performed, it does not add any substantial records of Pleistocene vertebrate genera.

Ovibos sp.: The supposed ovibovine scapula reported by Volk (1911) (AMNH 20/12269) is so poorly preserved that its identification to family does not seem possible. I prefer to cite it as Artiodactyla, indeterminate. Fortunately, the presence of *Symbos* has confirmed the presence of ovibovines in this area.

Cervus sp.: An alleged elk antler (AMNH 20/12967) reported by Volk (1911) is so poorly preserved that it is difficult to confirm that it is an antler. Even so, it would not be identifiable to genus.

Mylohyus: A questionable record of this Pleistocene peccary was reported by Hay (1923), but no certain record exists. *Mylohyus* is known from a Pennsylvania cave near the Delaware Water Gap, and undoubtedly ranged into what is now New Jersey, but proof is lacking.



PU 16340
No Date 1950
Symbos cavifrons (Leidy)
Name
Quaternary.
Horizon Atlantic Ocean floor
Locality 40 mi. SE of Atlantic
City, N.J., in 30 F. water.
Collector David Leeds (scallop
dredger): don. per Carroll L.
Description Atkinson.
L. frontal & horn core.
Princeton Department of Geology

Figure 4. Symbos cavifrons, left frontal and horn core, dredged from the continental shelf 40 miles southeast of Atlantic City, N.J. (PU 16340). Scale in centimeters and inches.

Current Investigation

A particularly interesting specimen, NMNH 214459, is now being studied by Dr. Roger C. Wood of Stockton State College. This specimen is a horn core referable to the genus *Bos*. Its large size suggests comparisons with *Bos primigenius*, the Urus. It was found in peats off Brigantine. Dr. Wood has a paper in preparation that includes a complete description of this specimen and a discussion of its probable affinities.

Current Discoveries

Two additional specimens of *Rangifer tarandus*, the caribou, have been found within the last few years. Both were found at the Big Brook locality in Marlboro Township, Monmouth County, and are now in the personal collections of Frank Yuro of Edison and Andy Dillman of Perth Amboy. Both collectors kindly allowed me to examine and record the specimens.

The Yuro specimen is a basal fragment of a shed right antler with a portion of brow tine and main beam with some palmation.

The Dillman specimen is a basal fragment of a shed left antler with a portion of brow tine and over thirty centimeters of main beam, including some palmation and another tine.

Both specimens are large antlers, comparable in size to those of a trophy mount Alaskan specimen in the New Jersey State Museum taxidermy collections and more massive than ANSP 11576, the other New Jersey Pleistocene specimen. No reference to any living subspecies can be made, however.

Conclusions

The Pleistocene faunal record of New Jersey, which seems so promising, is actually rather poor. Reexamination of previously reported materials has actually reduced the number of genera and species reported from the area (Table 1). However, the presence of numerous Pleistocene deposits in New Jersey still suggests that fine discoveries may yet come. If deposits yielding multiple numbers of specimens and precise dates can be found, New Jersey may yet attain its deserved place in studies of Pleistocene Vertebrata, as Hay supposed so many years ago.

Table 1. New Jersey Pleistocene Megafauna

Megalonyx cf. *jeffersonii* Desmarest
Eremotherium mirabile (Leidy)
Castoroides ohioensis Foster
Odobenus rosmarus Linnaeus
Mammut americanum (Kerr)
Mammuthus primigenius (Blumenbach)
Equus complicatus Leidy
Cervalces scotti Lydekker
Rangifer tarandus Linnaeus
Symbos cavifrons (Leidy)

References

Bekoff, M, H. L. Hill, and J. B. Mitton. 1975. Behavioral taxonomy in canids by discriminant function analysis. Science 190:1223-1224.

Cross, D. 1941. Archaeology of New Jersey, Vol. 1. Trenton: Archaeological Society of New Jersey and New Jersey State Museum.

Doutt, J. K., C. A. Heppenstall, and J. E. Guilday. 1967. Mammals of Pennsylvania. Harrisburg: Pennsylvania Game Commission, 281 pp.

Guilday, J. E. 1958. The prehistoric distribution of the opossum. Journal of Mammalogy, 39:39-43.

Hay, O. P. 1923. The Pleistocene of North America and its vertebrated animals. Carnegie Institution of Washington Publication 322, 499 pp.

Jepsen, G. L. 1959, and later revisions. A New Jersey mastodon. New Jersey State Museum Bulletin 6, 20 pp.

Kardas, S. J., Jr. 1965. Notas sobre el género Odobenus (Mammalia, Pinnipedia) 1. Una nueva subespecie fósil del Pleistoceno superior--Holoceno. Bol. R. Soc. Espanola Hist. Nat. (Biol.) 63:363-380.

Kurtén, B., and E. Anderson. 1980. Pleistocene mammals of North America. New York: Columbia University Press, 442 pp.

Leidy, J. 1860. Remains of the walrus discovered on the coast of the United States. American Philosophical Society Transactions 2:83-86.

———. 1869. The extinct mammalian fauna of Dakota and Nebraska with a synopsis of the mammalian remains of North America. Academy of Natural Sciences of Philadelphia Journal 7, 472 pp.

McManus, J. 1974. Checklist, identification keys, and bibliography of New Jersey land mammals. New Jersey Academy of Science Journal 19(2):52-58.

Parris, D. C., and G. R. Case. 1980. Castoroides from New Jersey: Possible association with artifacts re-examined. Archaeological Society of New Jersey Bulletin 36:22-24.

Ray, C. E. 1975. The relationships of Hemicaulodon effodiens Cope 1869 (Mammalia: Odopenidae). Biological Society of Washington Proceedings 88(26): 281-304.

Rhoads, S. N. 1903. The mammals of Pennsylvania and New Jersey. Philadelphia: privately published, 266 pp.

Richards, H. G. 1951. Some recent discoveries of Pleistocene mammals from New Jersey. New Jersey Department of Conservation Bulletin, Geological Series, pp. 1-8.

Scott, W. B. 1885. Cervalces americanus, a fossil moose, or elk, from the Quaternary of New Jersey. Academy of Natural Sciences of Philadelphia Proceedings, pp. 181-202.

Volk, E. 1911. The archaeology of the Delaware Valley. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University, Vol. 5, 258 pp.

Whitmore, F. C., K. O. Emery, H. B. S. Cooke, and D. J. P. Swift. 1967. Elephant teeth from the contiental shelf. Science 156:1477-1480.

Woolman, L. 1897. Stratigraphy of the Fish House black clay and associated gravels, fossil horse, unio, and plants. New Jersey Geological Survey, Annual Report of the State Geologist (for 1896), pp. 201-254.

ADDENDUM

RADIOCARBON DATES FOR THE SPARTA MASTODON

Introduction

Although mastodons, *Mammut americanum* (Kerr), are rather common fossils in New Jersey, Pennsylvania, and New York, relatively few specimens have been dated by radiocarbon. This is unfortunate since dates could provide information helpful not only to studies of extinctions of Pleistocene megafauna but also of the retreat of continental glaciation.

Although radiocarbon dates on bone are controversial (Martin, 1967), theoretically there is no more satisfactory way to obtain a date for an individual than by valid determinations on its bones, and it is desirable that validity be confirmed by independent determination methods. In the case reported here two distinct methods yielded dates of remarkable similarity.

Specimen

The Sparta Mastodon (NJSM 11268) was discovered in 1972 during construction of New Jersey State Route 15 on property formerly belonging to C. H. Habbart of Sparta Township, Sussex County, New Jersey (approximately 41° 0' 48" N., 74° 36' 58" W., Franklin quadrangle). Other locality information may be obtained from the New Jersey State Museum, Bureau of Science.

The specimen, a substantial portion of a skeleton, was dredged from a depth of about four meters, according to crane operator Ramon Casal, and other workers at the scene. The Habbart family, other local residents, amateur fossil collectors, and New Jersey State Museum employees collected the bones. They chose bone samples for potential radiocarbon dating, and sealed the specimens immediately in airtight containers.

NJSM 11268 had young adult dentition (with the second and third molars erupted, but the latter essentially unworn), and epiphyses were unfused in the femora, scapulae, and vertebral centra. It was a large individual, about one-fifth larger than the Bojak Mastodon (NJSM 11267), which is a mounted skeleton with a mature adult level of tooth wear, and complete epiphyseal fusion. Dental age estimates are based on the criteria of Saunders (1977).

The spoil piles consisted primarily of peat, muck, and gray clay, typical of the sediments of a mastodon site in this area (Drumm, 1963; Dumont and Ehlers, 1973). The bones had muck matrix adhering to them but could not be observed in place. The excavation area was essentially saturated with groundwater, again typical of mastodon sites. Although similar deposits yield numerous shells of freshwater gastropods and pelecypods, these were not in evidence at this site. The underlying lithology is gneiss of Precambrian age, apparently referrable to the quartz-oligoclase gneiss unit of Buddington and Baker (1961), although the locality is slightly outside the surface area of that unit as published. The site is just north of the Portland moraine (Wolfe, 1977).

Radiocarbon Test Results

Two analyses were performed by Geochron Laboratories Division of Krueger Enterprises, Inc., on the Sparta Mastodon bone sample, GX-5742-A. The apatite fraction gave an age of 12,320 ± 410 C^{14} years B.P. (A C^{13} analysis indicated that the bone apatite was uncontaminated.) A sample of bone gelatin from the specimen yielded a second date of 12,730 ± 360 C^{14} years B.P. The two samples thus showed excellent concordance.

Discussion

Pleistocene mammals from bogs in the area in question often yield well-preserved bone collagen. Radiocarbon dates from the collagen seem consistent with determinations on materials other than bone (Table 1). These dates are also consistent with determinations on bog sediments from the region (Buckley and Willis, 1970; Spiker et al., 1978) and determinations on coastal occurrences (Whitmore et al., 1967). The bog deposits of the region yield major proportions of mammalian skeletons, suggesting quick burial of the individuals, before decay and scattering could occur. Unquestionably, these bogs provide great protection against oxidation; decomposition of the materials, both plant and animal, proceeds rapidly upon exposure. It is therefore not surprising that NJSM 11268 yielded collagen sufficient for a date determination, particularly in view of its depth of burial, which was somewhat greater than those of most previous mastodon discoveries.

The lack of contamination of the bone apatite is unusual, however. There is no secure explanation for this lack of contamination. This bog deposit was located over Highland gneissic terrain, rather than Valley and Ridge terrain (which includes many carbonate rocks). This could have resulted in low levels of carbonate in the groundwater. The lack of molluscan shells in the bog sediments is also perhaps indicative of a low amount of carbonate in the depositional environment.

Conclusion

There is reason to believe that Wisconsin megafaunal specimens from peat bogs overlying gneissic terrain will yield consistent radiocarbon dates for bone collagen and bone apatite. The Sparta Mastodon is a specimen demonstrating such concordance, and testing of other specimens from the region could conclusively establish a method for cross reference of radiocarbon determinations on similar specimens.

Table 1. Radiocarbon Dates from the Atlantic Region

(Region delimited by Dreimanis, 1968)

Specimen	Approximate Location	Laboratory No.	Material	Date*	Reference
Marshalls Creek Mammut	Marshalls Creek, Pa.	I-3929	Wood	12,160 ± 180	Buckley and Willis (1970)
		I-3930	Wood	12,020 ± 180	Buckley and Willis (1970)
Bojak Mammut (NJSM 11267)	Liberty Twp., N.J.	GX-2675	Bone collagen	10,995 ± 750	Kraft (1973)
Ohberg Mammut	Vernon Twp., N.J.	L-231	Peat	10,890 ± 200	Dreimanis (1968)
Arborio Mammut	Montgomery, N.Y.	I-3785	Bone	10,000 ± 160	Funk et al. (1970)
Sugar Loaf Mammut	Middletown, N.Y.	I-6634	Bone	9,860 ± 225	Dumont and Ehlers (1973)
Dutchess Quarry Rangifer	Florida, N.Y.	I-4137	Bone collagen	12,530 ± 270	Buckley and Willis (1972)
Dewey-Parr Cervalces	W. of Florida, N.Y.	I-4016	Bone	10,950 ± 150	Buckley and Willis (1970)
Sparta Mammut (NJSM 11268)	Sparta Twp., N.J.	GX-5742 A	Bone apatite	12,320 ± 410	This report
			Bone collagen	12,730 ± 360	This report

* Radiocarbon years B.P.

Acknowledgements

I thank Daniel Dombroski (N.J. Bureau of Geology and Topography) and Shirley S. Albright (N.J. State Museum) for information on lithologies of the Precambrian gneiss. This note was suggested by Dr. Henry Krueger of Geochron Laboratories, who deserves credit for initiating the dual date determination.

References for Addendum

Buckley, J., and E. Willis. 1969. Isotopes radiocarbon measurements VII. Radiocarbon 11(1):53-105.

———. 1970. Isotopes radiocarbon measurements VIII. Radiocarbon 12(1):87-129.

———. 1972. Isotopes radiocarbon measurements IX. Radiocarbon 14(1):114-139.

Buddington, A. F., and D. Baker. 1961. Geology of the Franklin and part of the Hamburg quadrangles, New Jersey. U.S. Geological Survey Miscellaneous Geologic Investigations Map I-346.

Dreimanis, A. 1968. Extinction of mastodons in eastern North America: Testing a new climatic-environmental hypothesis. Ohio Journal of Science 68(6): 257-272.

Drumm, J. 1963. Mastodons and mammoths, Ice Age elephants of New York. University of New York State Museum and Science Service Educational Leaflet 13, 31 pp.

Dumont, E., and W. Ehlers. 1973. The Sugar Loaf Mastodon. New York State Archaeological Association Bulletin.

Funk, R., D. Fisher, and E. Reilly. 1970. Caribou and Paleo-Indian in New York State: A presumed association. American Journal of Science, 268:181-186.

Hartnagel, C. A., and S. C. Bishop. 1923. The mastodons, mammoths, and other Pleistocene mammals of New York State. New York State Museum Bulletin, nos. 241-242, 110 pp.

Kraft, H. C. 1973. The Plenge Site: A Paleo-Indian occupation site in New Jersey (preliminary report). South Orange: Archaeological Research Center, Seton Hall University Museum, 73 pp.

Martin, P. S. 1967. Prehistoric overkill. In: Martin and Wright (eds.), Pleistocene extinctions: The search for a cause. New Haven: Yale University Press, pp. 75-120.

Reilly, E. M. 1974. New York elephant hunt. The Conservationist.

Saunders, J. J. 1977. Late Pleistocene vertebrates of the Western Ozark Highland. Illinois State Museum Reports of Investigations, no. 33, 118 pp.

Spiker, B., L. Kelley, and M. Rubin. 1978. U.S. Geological Survey radiocarbon dates XIII. Radiocarbon 20(1):139-156.

Sullivan, B., E. Spiker, and M. Rubin. 1970. U.S. Geological Survey radiocarbon dates XI. *Radiocarbon* 12(1):319-334.

Whitmore, F. C., Jr., K. O. Emery, H. B. S. Cooke, and D. J. P. Swift. 1967. Elephant teeth from the Atlantic continental shelf. *Science* 156:1477-1481.

Wolfe, P. E. 1977. *The geology and landscapes of New Jersey*. New York: Crane, Russak, and Co., 350 pp.